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Preliminary Investigations of Erosional and Accretional Hotspots along the Ghanaian Coast

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Award Number: N00014-10-IP-20085

LONG-TERM GOALS

The long-term goals associated with this project are to develop a better understanding of the processes that dominate local coastal geomorphological change in Ghana, to enhance the transfer of technology and scientific knowledge necessary for the University of Ghana to further develop the capabilities to predict, manage, and mitigate hazards along the Ghanaian coastal zone, and to help the Ghanaians establish a self-sustaining coastal processes program. A better understanding of the processes driving coastal erosion in Ghana can then be extended to help mitigate similar problems along the entire West African coast, which could lead to better maritime governance and increased social stability in the region.

OBJECTIVES

The objectives of the activities conducted under this grant are to identify sections of the coast both around and east of Accra, the capital of Ghana, that are experiencing significant erosion or accretion, and to begin discussing with local researchers if the observed changes are associated with the local wave climate. The discussions will include identifying in which coastal areas the local wave forcing can be understood through simple two-dimensional momentum balance type analyses and which coastal areas will require significantly more complex three-dimensional numerical wave modeling.

APPROACH

Engage in scientific collaborations with faculty and students at the University of Ghana, primarily during a week-long site visit. Spend three days in the field surveying beaches around and east of Accra. Spend three days at the University of Ghana discussing future collaborations, including the development of a country-scale numerical wave model and the ongoing work being conducted by the faculty and students at the university.

WORK COMPLETED

A week-long site visit was conducted in late June 2010 in conjunction with Andrew Ashton of the Woods Hole Oceanographic Institution, Cheryl Hapke of the USGS, and with Drs. George Wiafe and Kwasi Appeaning Addo and Mr. Selorm Ababio of the University of Ghana. During a three day field

survey, more than seven different coastal areas were evaluated for both the extent of erosion or accretion that was occurring, as well as the potential for these changes to be owing to the local wave dynamics. During three days at the university, ongoing projects as well as possible future collaborations were discussed with the faculty and students. Specific interest was shown in the development of a large-scale numerical wave model and application by the PI for funding to spend an extended period working at the University of Ghana.

RESULTS

Several coastal areas were identified that have the potential to be significantly influenced by the local wave dynamics. For example, one area that had experienced significant erosion in the past nine months was located down-drift from a protruding headland. This headland likely affects the angle of the incoming waves, resulting in areas of flow convergence and divergence, which may dictate the patterns of erosion and deposition down-coast. At the one site where significant accretion was observed, there was no obvious link to the local wave dynamics. However, long-term model simulations of the local wave climate may indicate important processes that are not obvious from a single site visit. In general, while much of the coastal change may be related to the underlying geomorphology or anthropogenic causes, there is a strong possibility that variations in the incoming waves also play an important role.

IMPACT/APPLICATIONS

This project addresses growing concerns over coastal erosion in developing countries, especially in West Africa. Over the short term, this project has resulted in the application by the PI for a Fulbright grant to spend nine months working at the University of Ghana, where he will develop, in conjunction with the faculty and students, a country-scale numerical wave model and begin relating the model predictions to areas of erosion and accretion. The development of numerical modeling capabilities at the University of Ghana is important to allow for full advantage to be taken of the university's growing field data collection capabilities, and to increase the capacity of researchers at the university to further develop the models as more field observations, including better nearshore bathymetry, become available. In the longer term, this project will help the PI develop scientific collaborations with the faculty and students at the university, as well as increase the capacity of the local researchers to conduct studies of the nearshore wave and sediment transport processes in both Ghana and along the entire West African coast.

RELATED PROJECTS

Award Number: N00014-09IP20077
PI: Cheryl Hapke (USGS)
Africa Partnership Station:
Coastal Geomorphology and Hazards Planning

Award Number: N00014-08-1-0997
PI: Andrew Ashton (WHOI)
Africa Partnership Station:
Coastal Geomorphology and Hazards Planning